Noxious Weed Survey Results

There were no noxious weeds growing within the Biological Survey area. There are scattered individuals of common tansy (*Tanacetum vulgare*) occurring along roadsides near the boundary of the BSA. Tansy is a Class C weed (control not required).

Two other Class B noxious weeds were found on previous surveys within Mt. Spokane State Park, but outside the BSA (Smith 2009, Wooten and others 2009). These species are orange hawkweed (*Agoseris aurantiaca*) and Dalmatian toadflax (*Linaria dalmatica*). Monitoring and management of these noxious weeds was discussed in earlier reports. These species do not occur within the BSA at this point in time (based on our survey results). This is largely due to the fact that these species thrive on disturbance and largely inhabit open areas and the BSA is now mostly forested. It is quite possible that these species may spread within the Biological Survey Area if significant disturbance opens the canopy and disturbs the ground. Then, control measures for noxious weeds may be necessary.

Wildlife Habitat Survey Results

Our more detailed habitat surveys of the Biological Survey Area (BSA) were initially based on the polygon mapping and reconnaissance-level habitat data collected for the larger SEIS Analysis Area. Eighty four polygons in the SEIS Analysis Area overlapped or were included in the BSA. The BSA intersected some of the polygons in the SEIS Analysis area in a way that the original polygons were split into two parts or more. Since our more detailed habitat surveys in the BSA were somewhat independent of the reconnaissance-level work in the larger analysis area, we gave each split polygon part a new number. This resulted in a total of 92 polygons in the BSA (Figure 7).

As describe in the Methods section of this report, the polygons were each attributed with quantitative habitat information based on a combination of ecology plot data, other field survey information, aerial photo analysis and our expert judgment. One of the steps of this process was to analyze the forest habitat plot data and to interpolate this to the BSA landscape using an inverse distance weighted interpolation technique (Philip and Watson 1982, Watson and Philip 1985). An example of the result of this technique is shown in Figure 8, which illustrates the tallest trees in the forest stands within the BSA. This information is interpolated from recorded tallest tree in each plot, which is labeled in this illustration. Tree canopy height is a habitat variable that can influence many bird species, including the northern goshawk, which is an important bird of prey at Mt. Spokane.

All the detailed habitat information was compiled into a database, which was eventually transferred into a spatial database attached to a Biological Survey Area habitat polygon layer. Each polygon is attributed with 35 quantitative or descriptive habitat attributes. Some of the more important attributes are illustrated in maps in the following section of this report. All of the data for each polygon is summarized in the polygon descriptions that are presented in Appendix A.

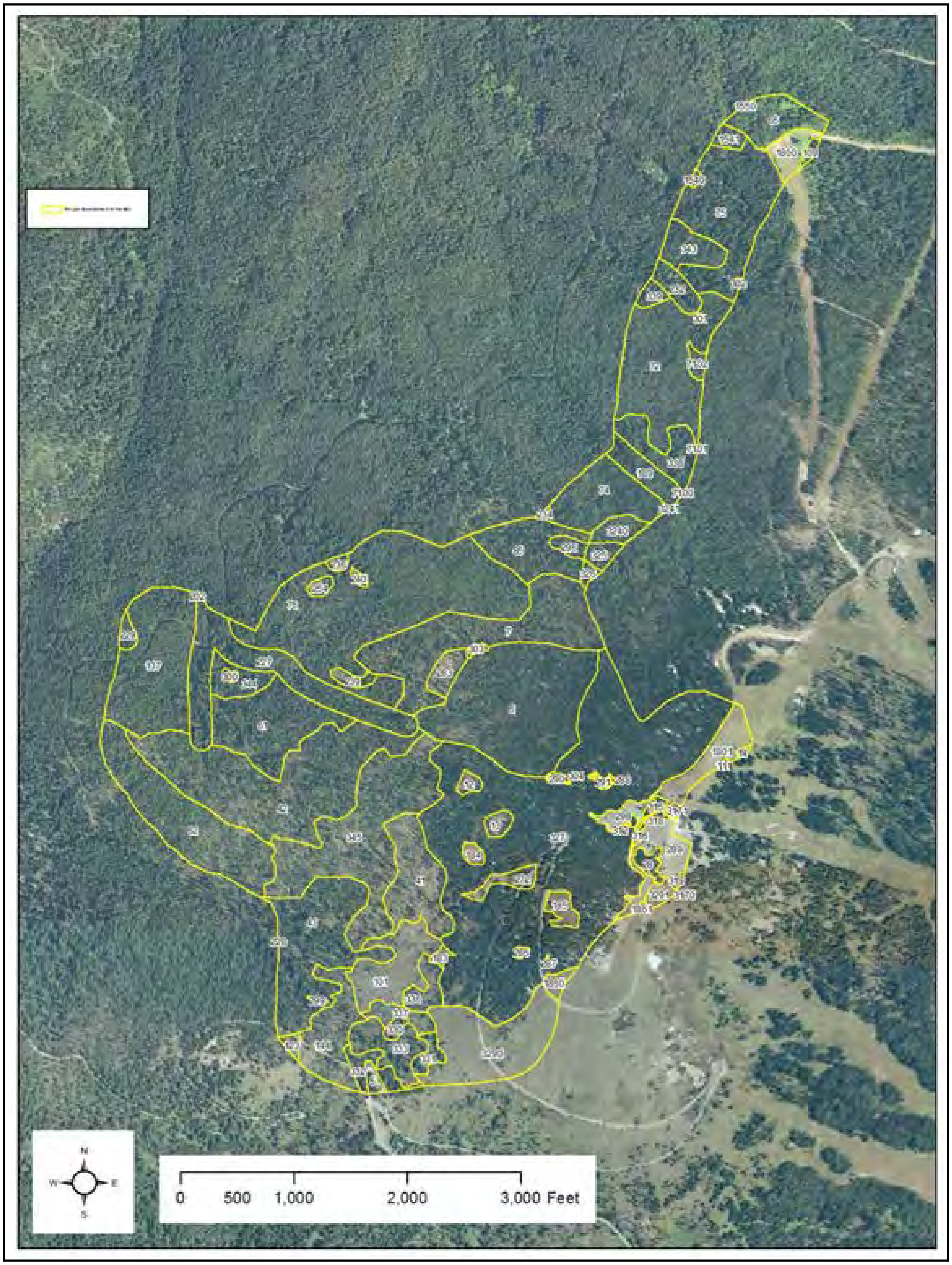

Figure 7. Habitat polygons within the Biological Survey Area.

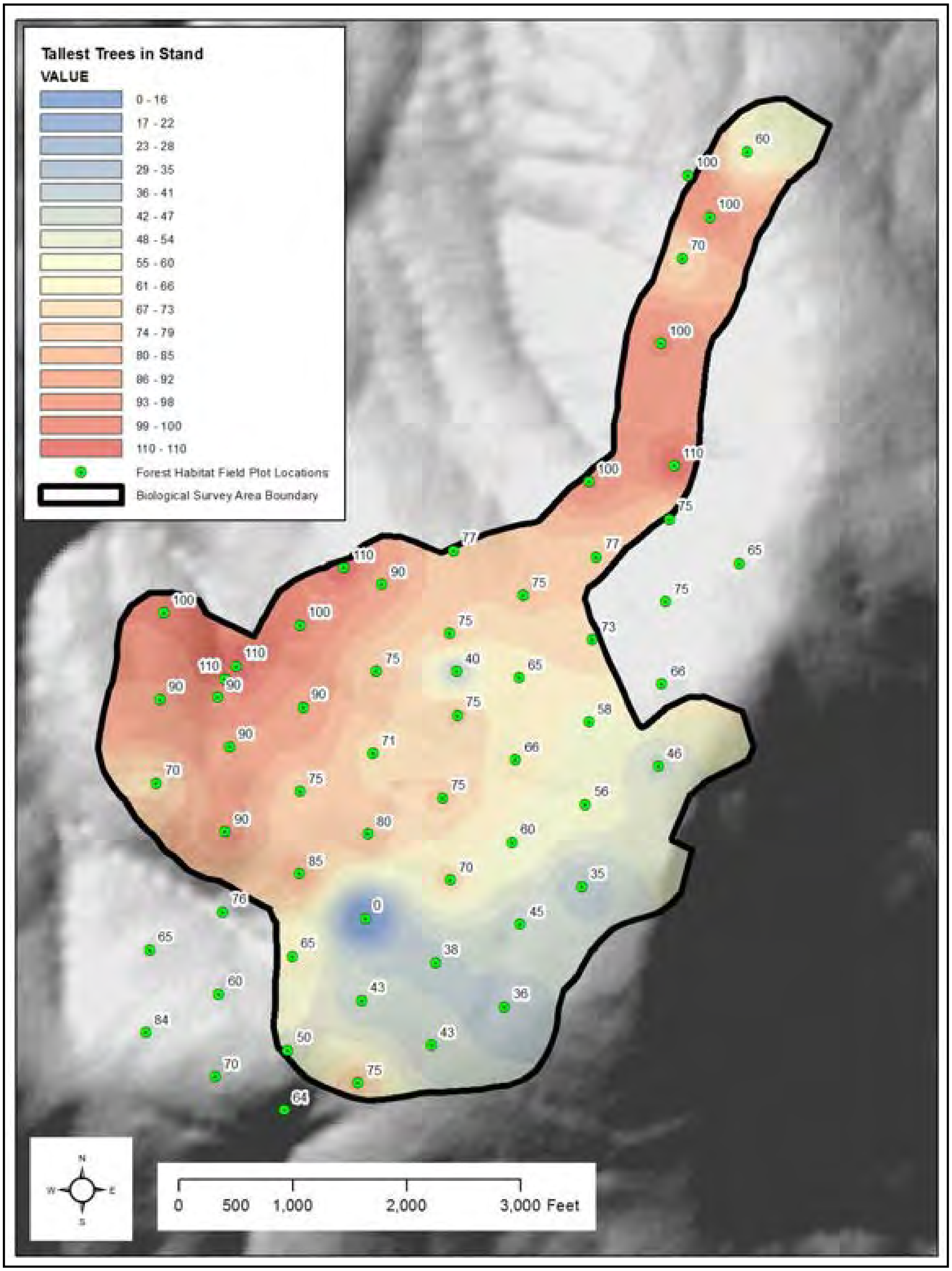

Figure 8. Tallest trees in the Biological Survey Area - an illustration of the IDW interpolation technique.

Detailed Wildlife Habitat Information for Polygons within the Biological Survey Area

This section of the report provides an example of some of the data contained within the Biological Survey Area (BSA) polygon database. All of this information is also included in the polygon descriptions that are presented in Appendix A. The following section is organized by major wildlife habitat themes.

Plant Associations

Field surveys identified 32 plant associations within the BSA, 22 of which were primary plant associations (PAs), including non-vegetative cover types such as talus, developed areas or ski runs. These are listed in Table 1 along with all other plant associations recorded within the SEIS survey area. Plant associations are a key habitat attribute for many wildlife species.

Table 6 lists the primary plant associations within the BSA, along with number of polygons and area covered by each. The distribution of primary plant associations is illustrated in Figure 9.

Table 6. Area and number of polygons within the BSA covered by the 22 primary plant associations.

PA	No. Polygons	Acres
ABGR/ACGL/CLUN2	2	22.4
ABGR/VAME	1	0.8
ABGR/VAME/CLUN2	2	1.1
ABLA/ATFI	2	2.2
ABLA/LUGLH	1	2.4
ABLA/MEFE	4	44.0
ABLA/TRCA	1	0.3
ABLA/VAME	5	9.7
ABLA/XETE	29	260.4
ALVIS/ATFI	1	0.1
ALVIS/Mesic Forb	3	1.9
ALVIS/SETR	1	4.8
Developed	3	9.7
ERUMM-FEVI	2	15.6
FEVI-FEID	5	4.9
PHDI3/FEVI-HICY	1	0.4
Talus	6	5.8
TSHE/ATFI	5	11.1
TSHE/CLUN2	11	42.7
TSHE/GYDR	2	15.4
TSHE/MEFE	3	15.9
TSHE/XETE	2	18.8
TOTAL		**490.4**

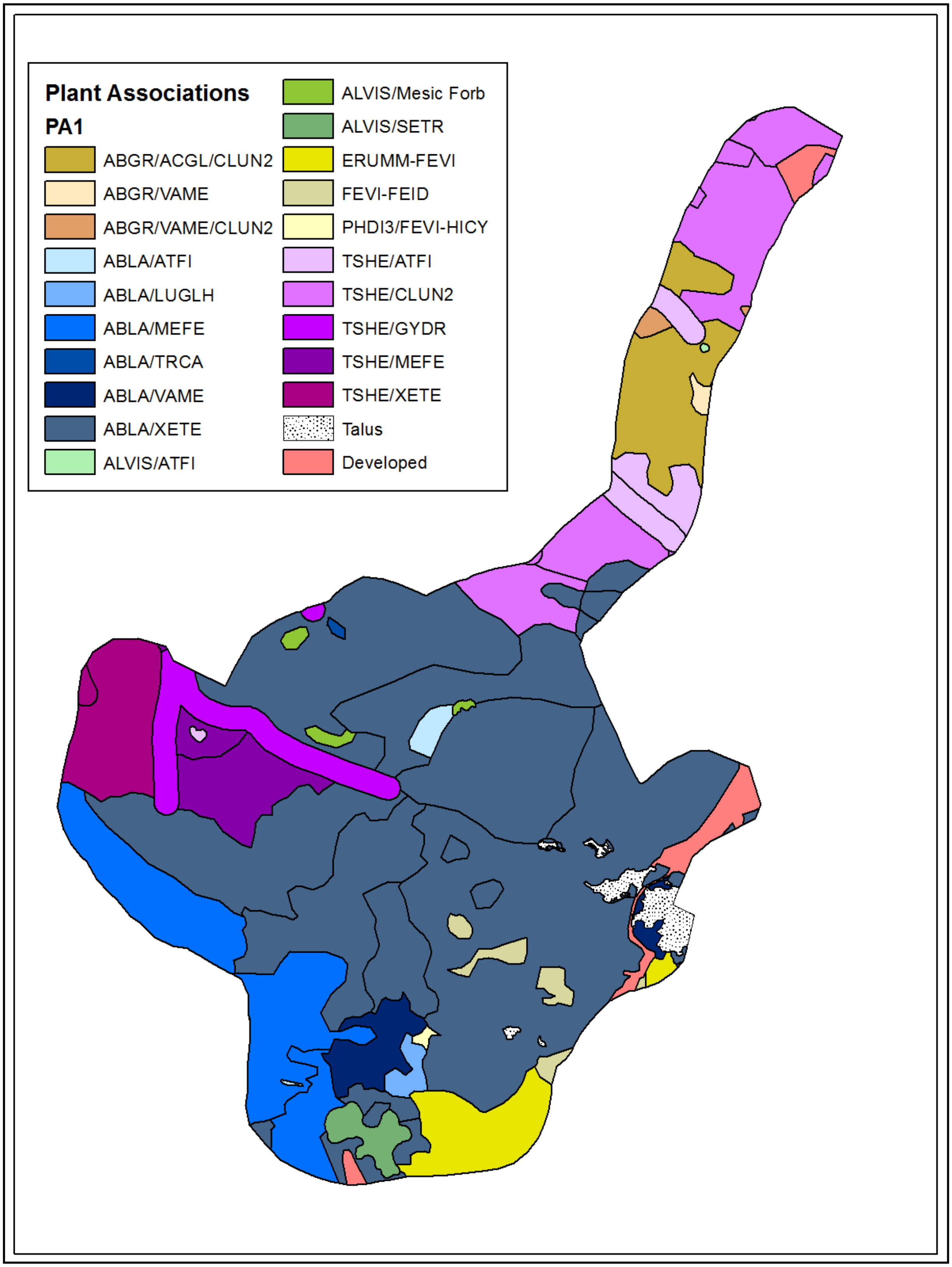

Figure 9. Primary plant associations within the BSA.

Forest Canopy Layers and Cover

Forest canopy cover (Figure 10) represents the amount of the sky that is covered by a forest canopy. It is one of the most important indicators of forest condition and determines the amount of light that reaches understory vegetation. This is an important habitat determinant for many wildlife species. The number of forest canopy layers is also an important habitat attribute for many wildlife species (Figure 11). Similar to total canopy cover is an estimate of the total tree cover (Figure 12). This can differ from canopy cover in that tall shrubs are excluded while small trees are included.

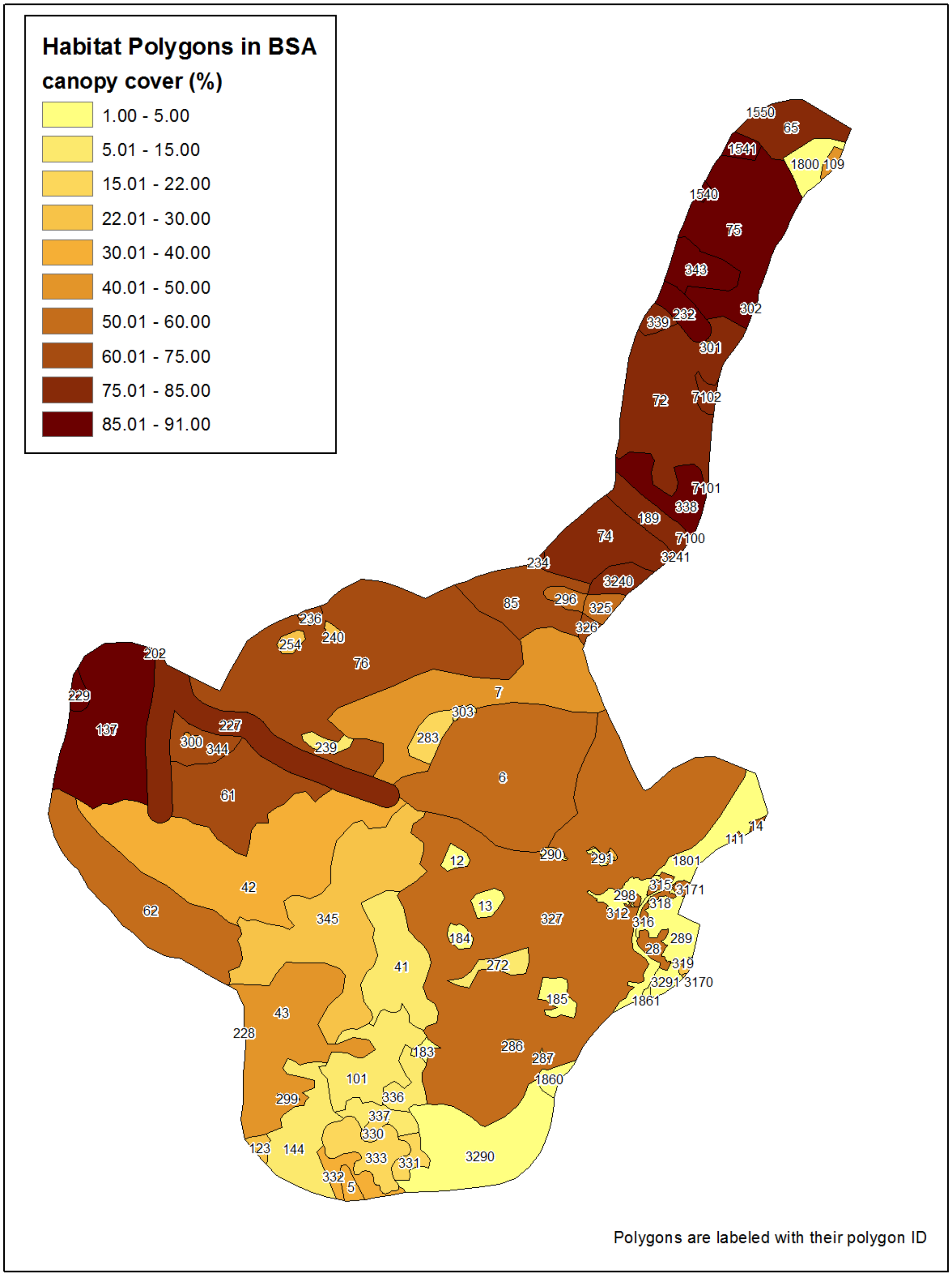

Figure 10. Forest canopy cover in BSA.

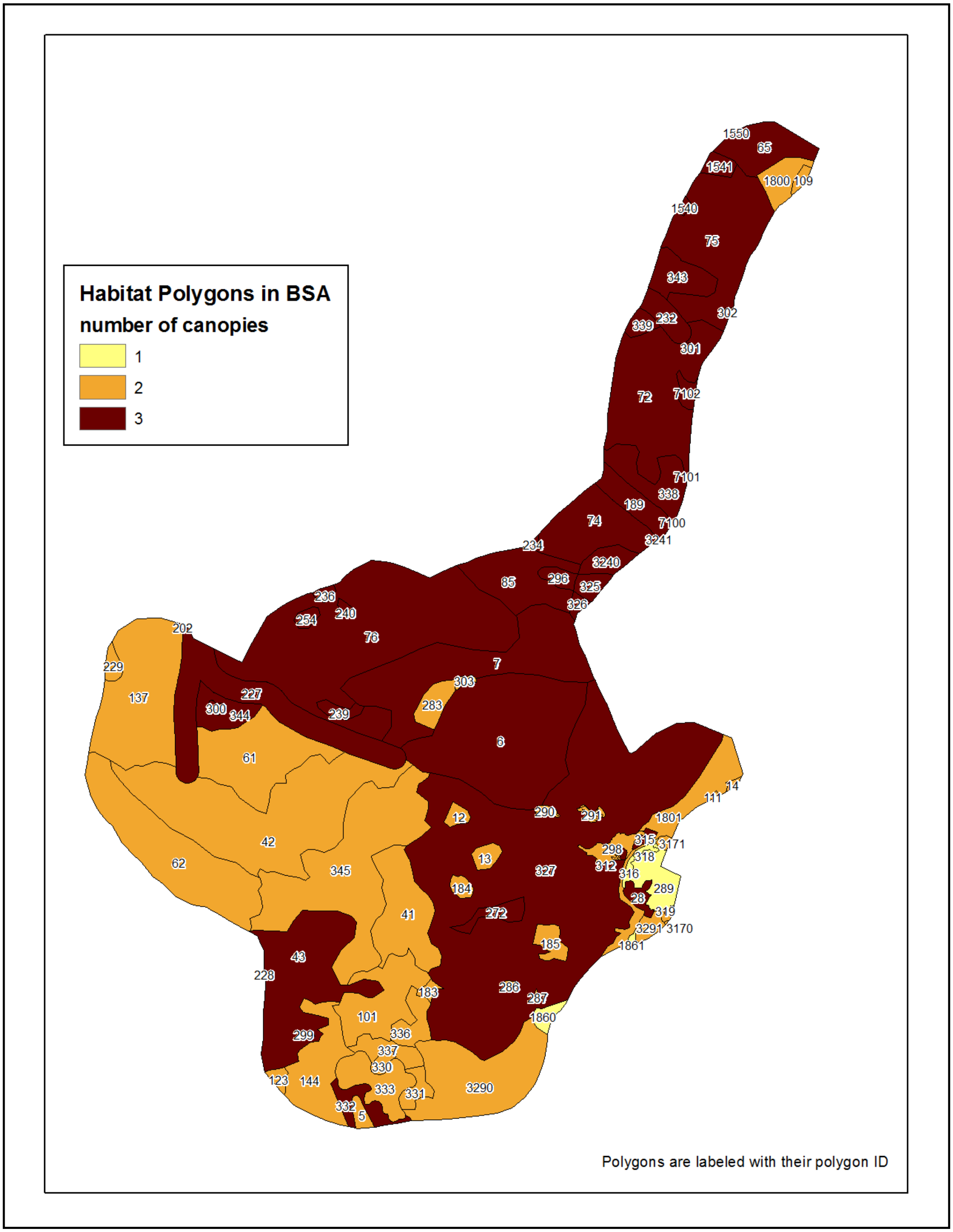

Figure 11. Number of canopy layers in BSA.

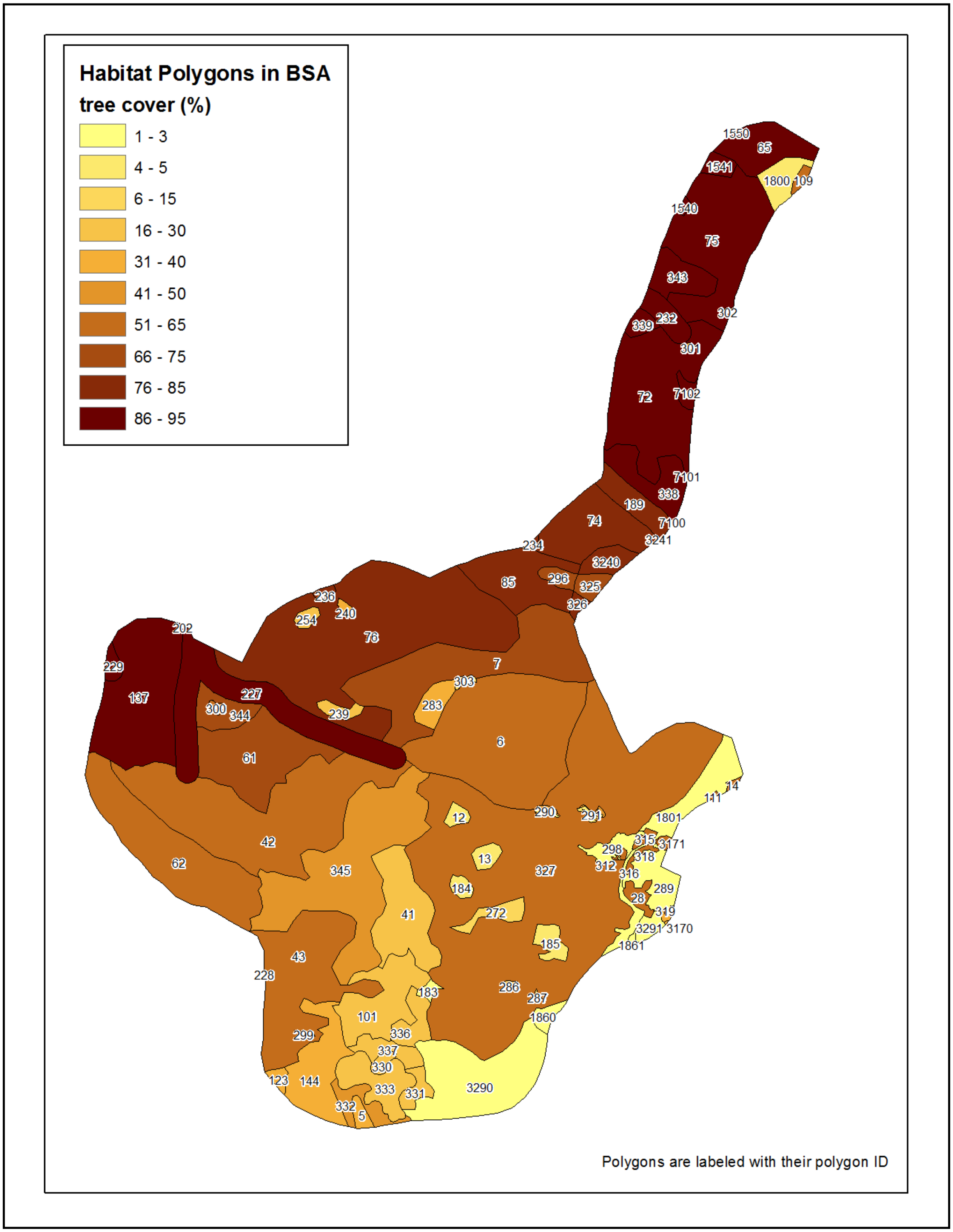

Figure 12. Total tree cover in BSA.

Tree Diameters

Large diameter trees (> 20 inches DBH) are very important habitat for many wildlife species. The BSA has a wide range of tree diameters. The size of the biggest trees in each polygon in the BSA is illustrated in Figure 13. Many polygons have at least some trees that exceed 20 inches DBH. These forest stands contain at least minimal habitat conditions for species that depend on large trees for all or part of there life stages.

In addition to the presence of individual large trees, we also assessed whether there were sufficient large trees per acre in a polygon to come close to approximating old growth forest conditions. Old growth forest conditions are optimal for some wildlife species. We consider the stands containing a density of over 8 trees per acre of trees that are over 20 inches DBH to meet one of the most important old growth forest attributes. Figure 14 illustrates the maximum diameter (maxdbh) of the trees in a stand that comprise a density of 8 trees (or more) per acre of that diameter class. The polygons that have maxdbh of 20 inches DBH or higher should be considered as potential old-growth forest. These stands usually have the best habitat conditions for wildlife species that depend on old-growth or late-successional forest conditions.

Quadratic mean diameter is another expression of the size and age of a forest stand. The quadratic mean diameter is the diameter of the tree with the arithmetic mean basal area (cross-sectional area) (Husch et al 1982). We calculate the quadratic mean diameter based on all the trees sampled in a variable radius plot. It is a more meaningful measure of the stand diameter than the simple mean diameter and is illustrated in Figure 15. Stands with a high quadratic mean diameter are also a sign that the stand is approaching old growth forest condition and that it has many of the habitat attributes needed by wildlife species that depend on late-successional forest conditions.

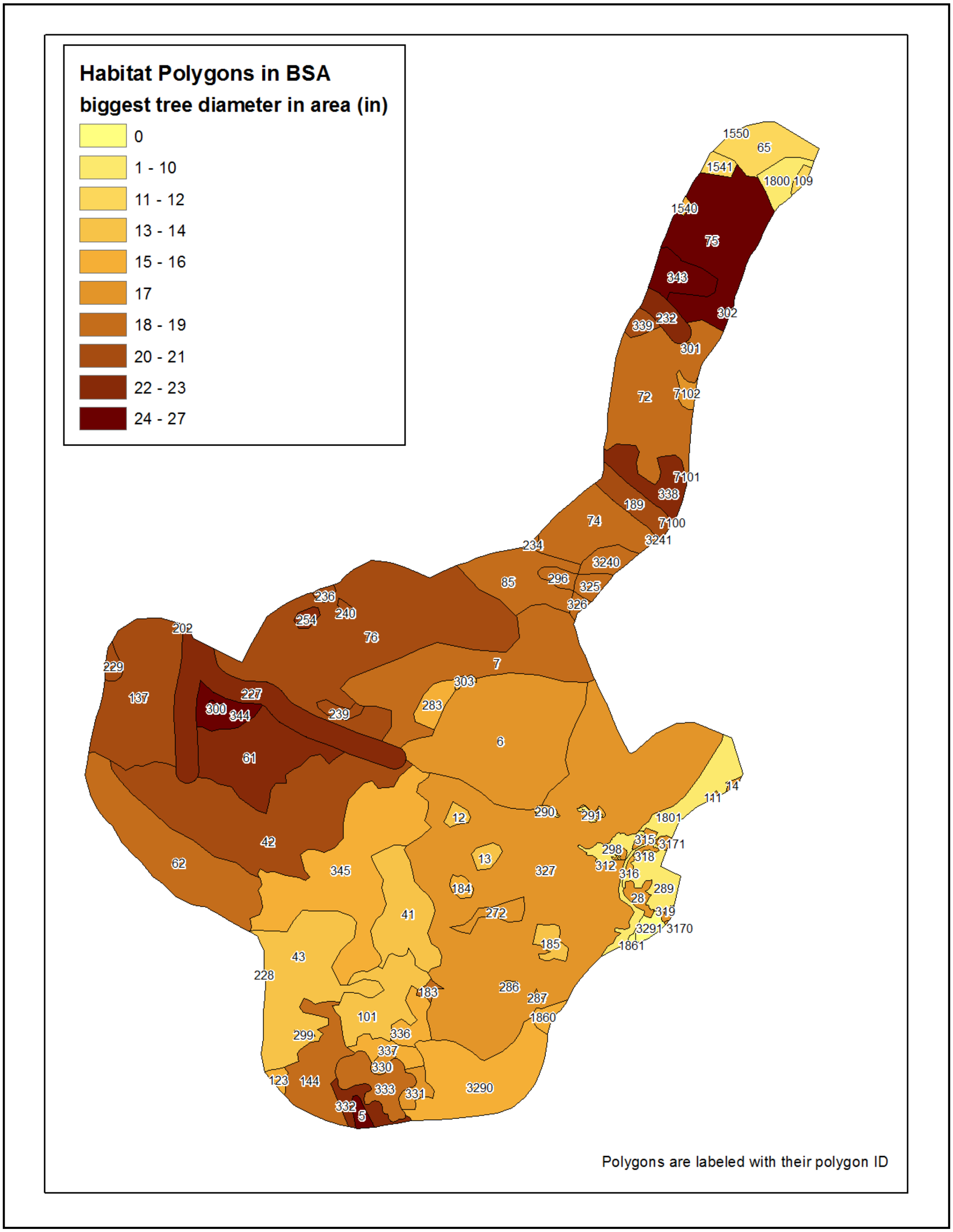

Figure 13. Diameter of biggest trees in the stands in the BSA.

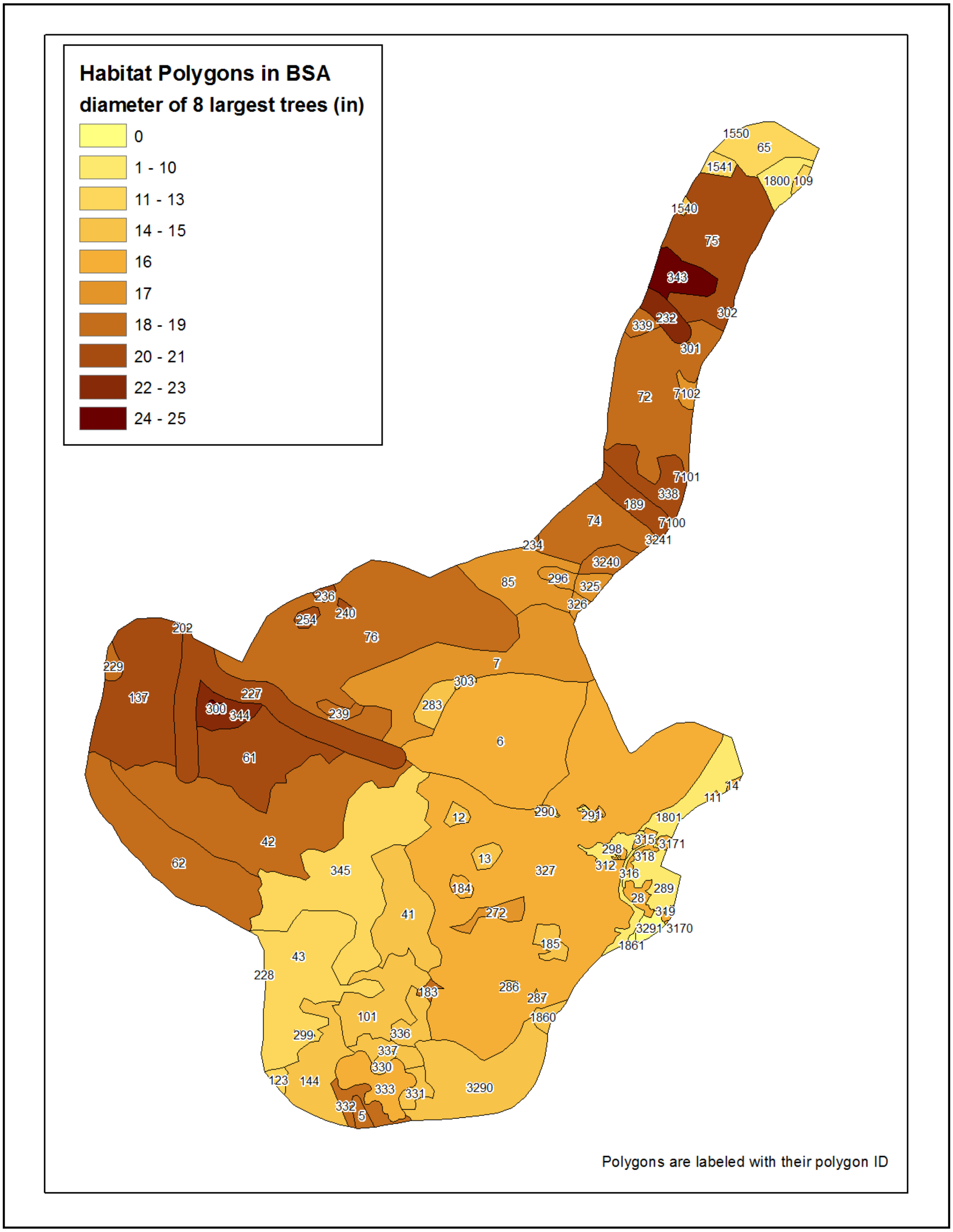

Figure 14. Diameter of the 8 largest trees in the stands in the BSA (maxDBH).

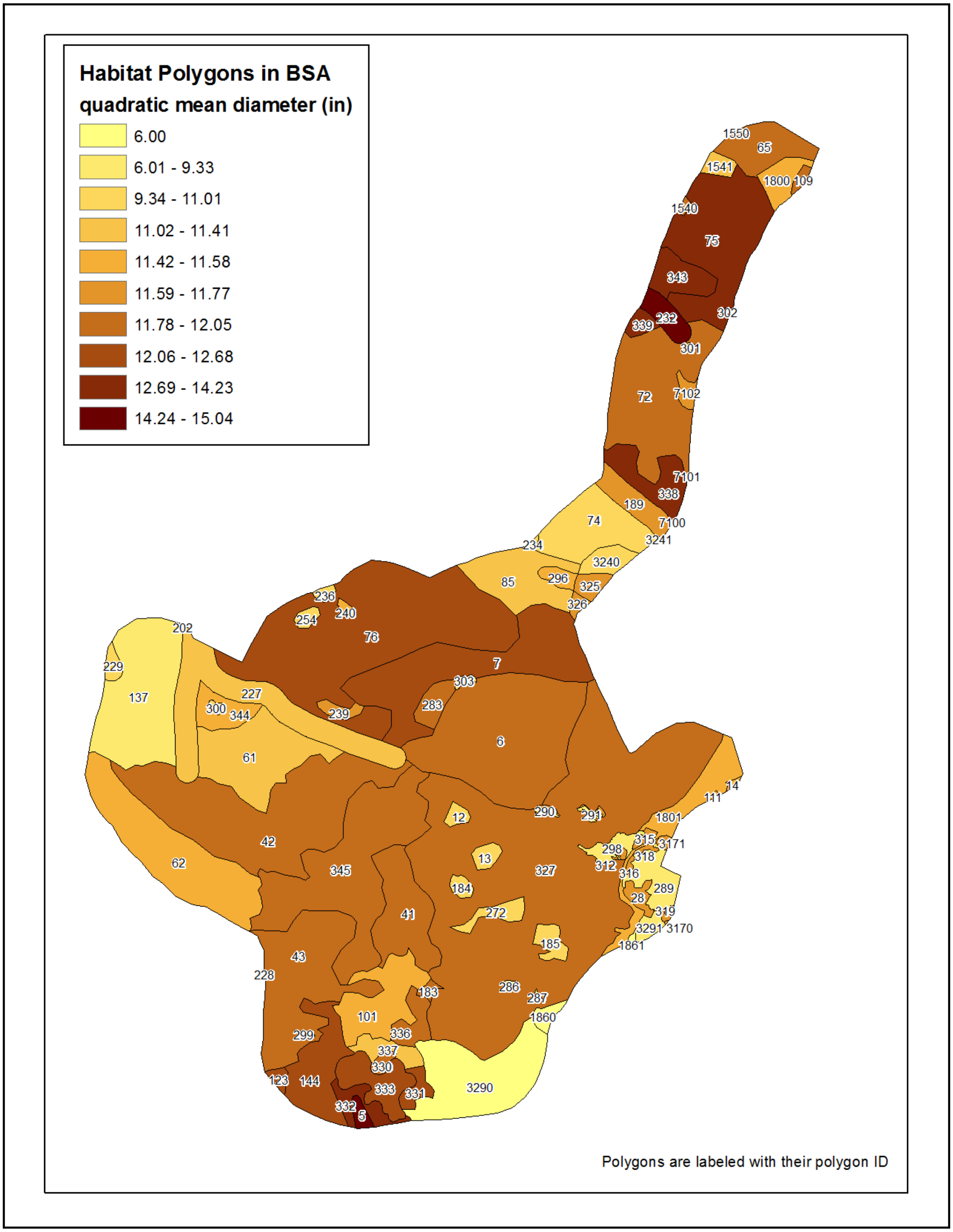

Figure 15. The quadratic mean diameter of the trees in the stands in the BSA (qmd).

Tree Density

The density of trees in a stand (stem density) is another important measure of forest condition and wildlife habitat. It is calculated by determining the number of tree stems per unit area (Figure 16). Our calculation of tree density was based on trees sampled in the variable radius plots, and so it does not include trees less than 6 inches DBH. High-density stands often have intense competition between trees for sunlight, water and nutrients. This often results in eventual mortality of the less competitive trees. Low-density stands often have ample room for trees to grow, however there may be very dense shrub understories and intense competition in the understory. Wildlife often prefer the less dense stands.

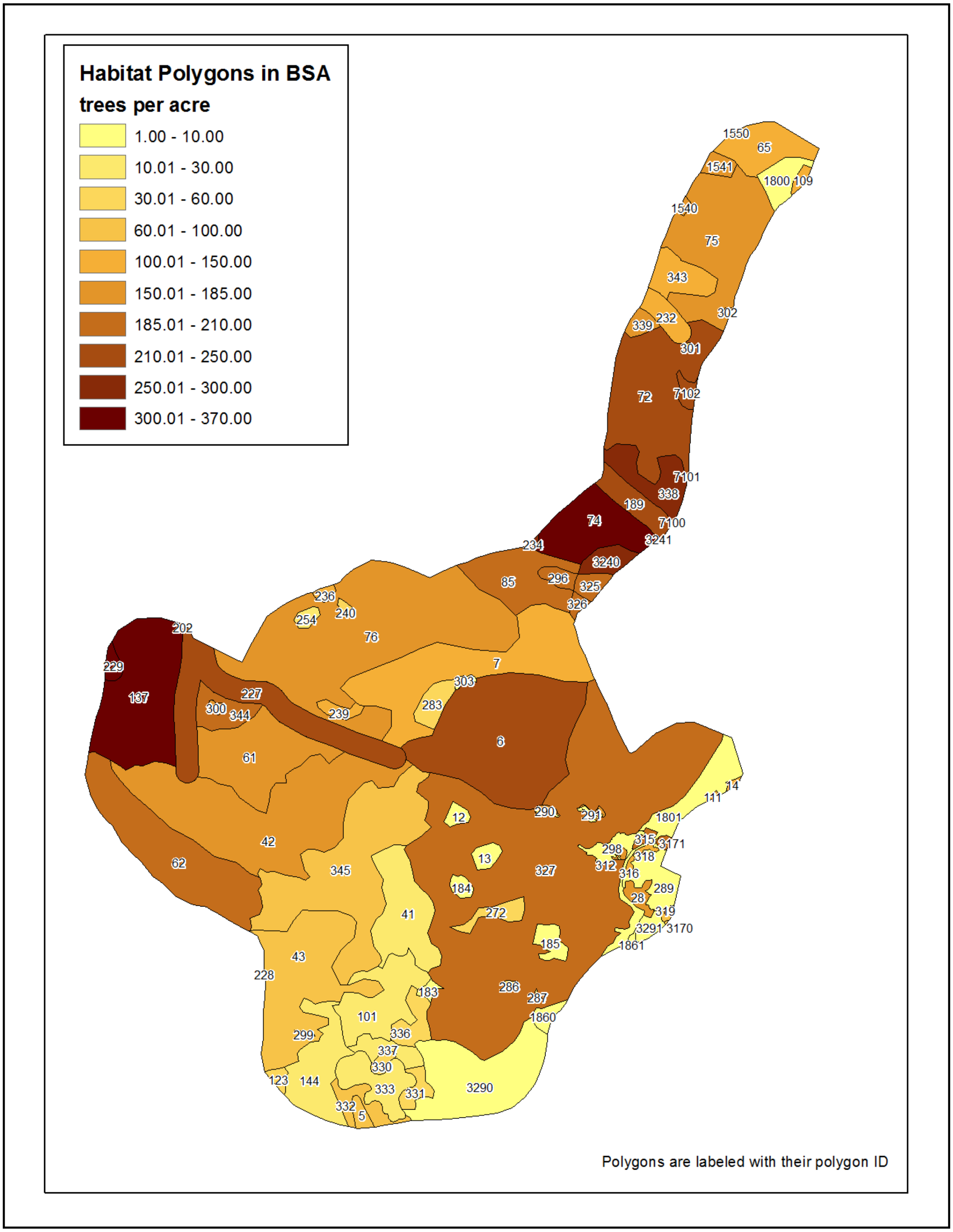

Figure 16. The number of trees per acre in the stands in the BSA (tpa).

Canopy Height

The forest canopy height is an important factor for some wildlife species. This is illustrated by maps of both the tallest trees in the stands (Figure 17) and the average tree height (Figure 18)

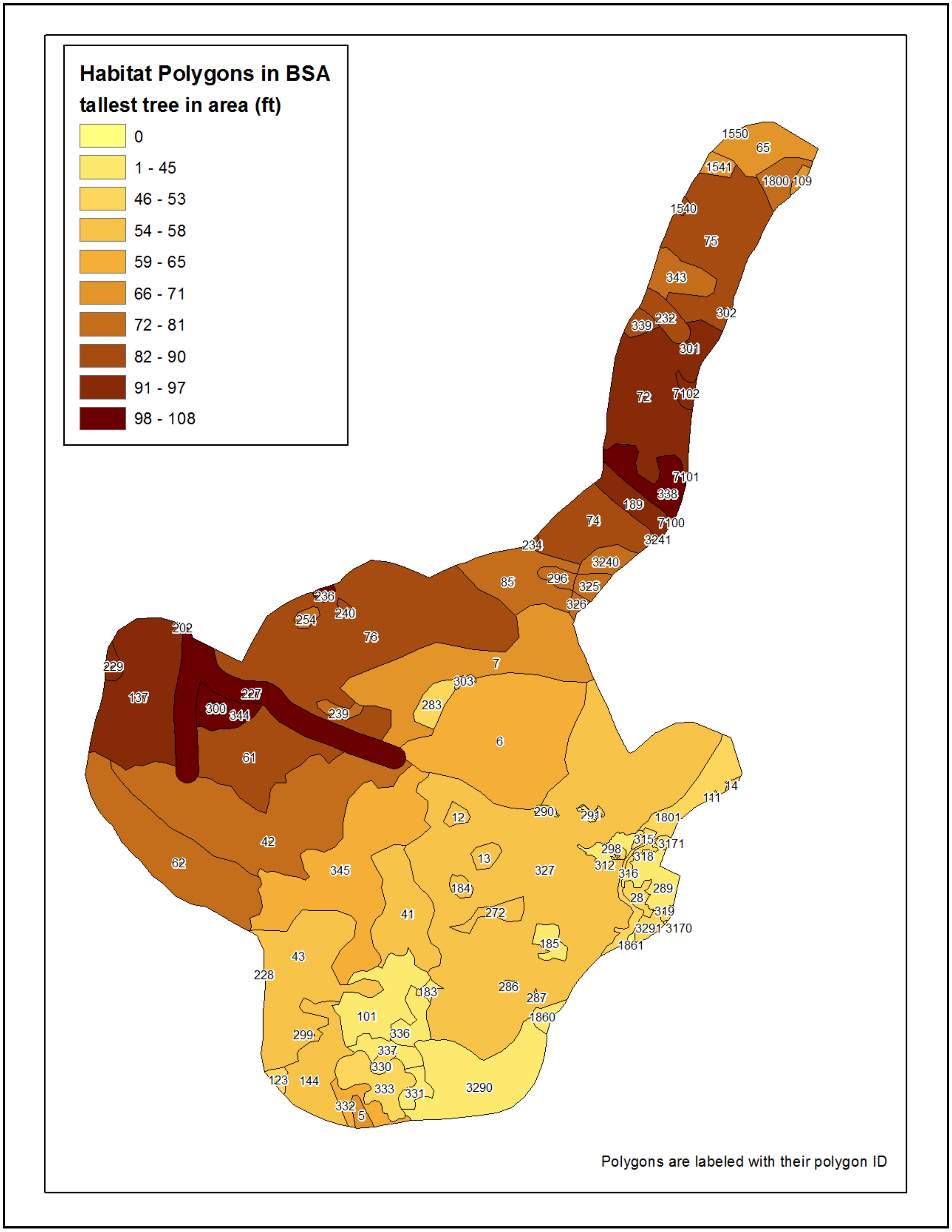

Figure 17. The tallest trees in the stands in the BSA.

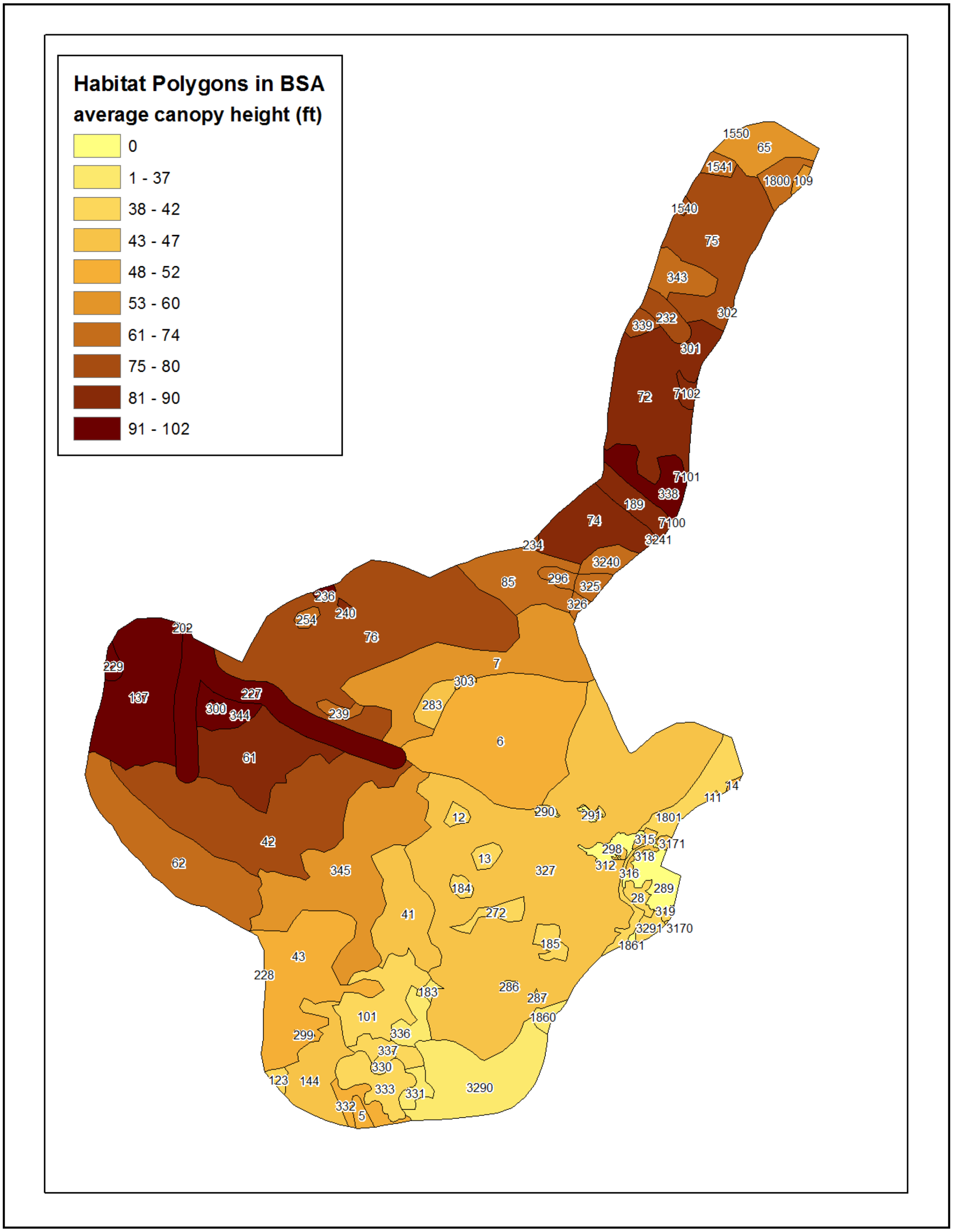

Figure 18. The average tree height in the stands in the BSA.

Basal Area

Basal area is simply a measure of the cross-sectional area of each stem, in this case the stems of the live trees. We calculated the basal area of each tree and then summed these values on a per acre basis for each forest survey plot. Figure 19 illustrates basal area as it varies throughout the project area as determined by IDW interpolation from the plot data. Basal area is one of the factors that determine the total biomass in a forest stand.

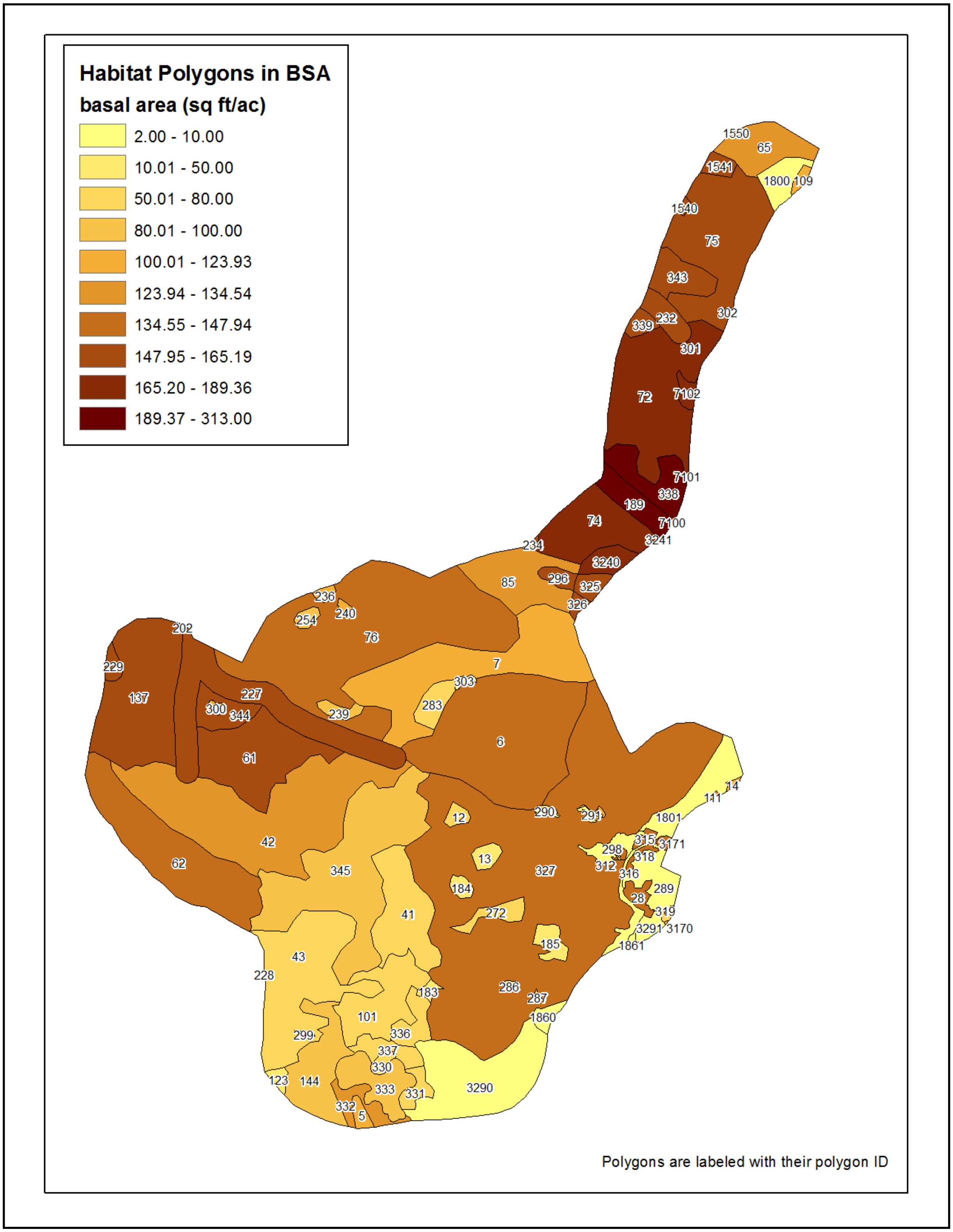

Figure 19. The basal area of the stands in the BSA.

Stand Density Index

Stand density index (SDI) is a measure of relative stand density, allowing comparisons between stands comprised of different species and diameters (Husch et al 1982). We calculated SDI using a new method developed by Woodall and Miles (2004) from our plot data and the result is depicted in Figure 20. Stand density index (SDI) was originally developed for use in even-aged monocultures, but has been used more recently for stand density assessment in large-scale forest inventories. Woodall and Miles (2004) improved the application of SDI in uneven-aged, mixed species stands present in large-scale inventories, through development of a model whereby a stand's maximum SDI was calculated as a function of the stand's mean specific gravity (SG) of individual trees.

SDI is usually not strongly correlated with age or site index. This quality of independence of age and site makes SDI a valuable parameter in describing a stand. It can be an important metric for determining wildlife habitat for some species.

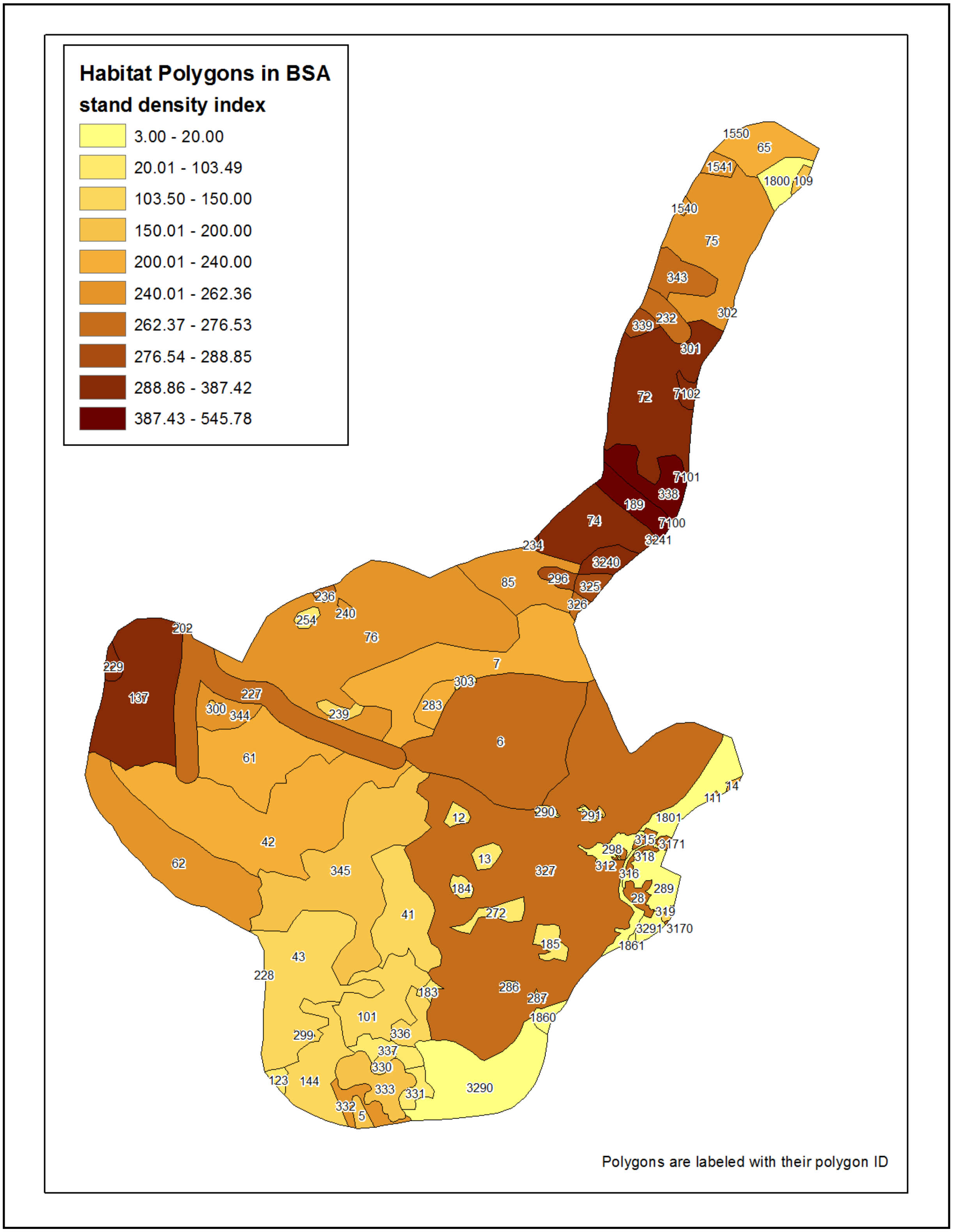

Figure 20. The stand density index of the stands in the BSA.

Shrub and Herbaceous Cover

The amount of shrub cover and herbaceous cover can be important determinants for many wildlife species. These wildlife habitat attributes are illustrated in Figures 21 and 22.

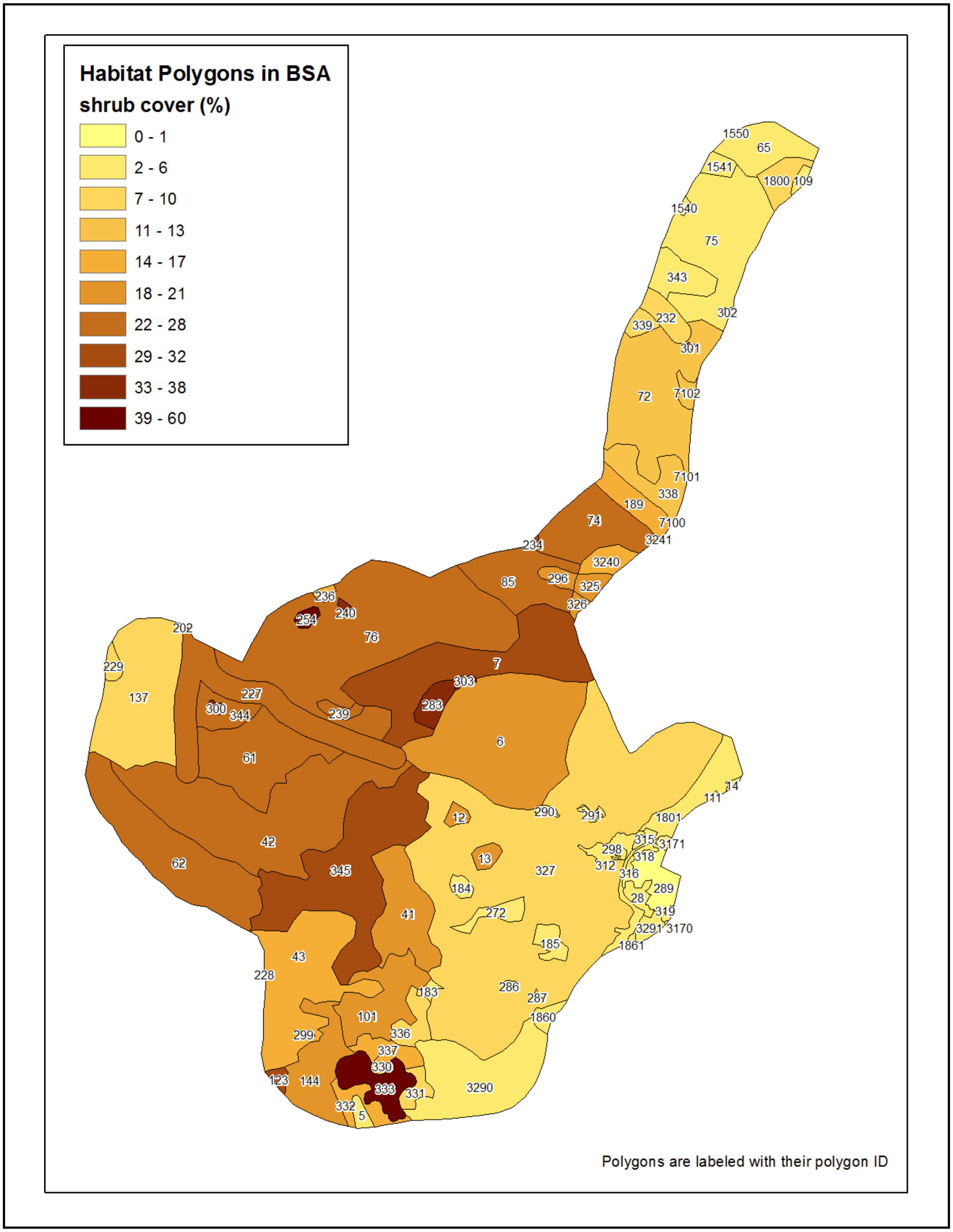

Figure 22. The shrub cover in the stands of the BSA.

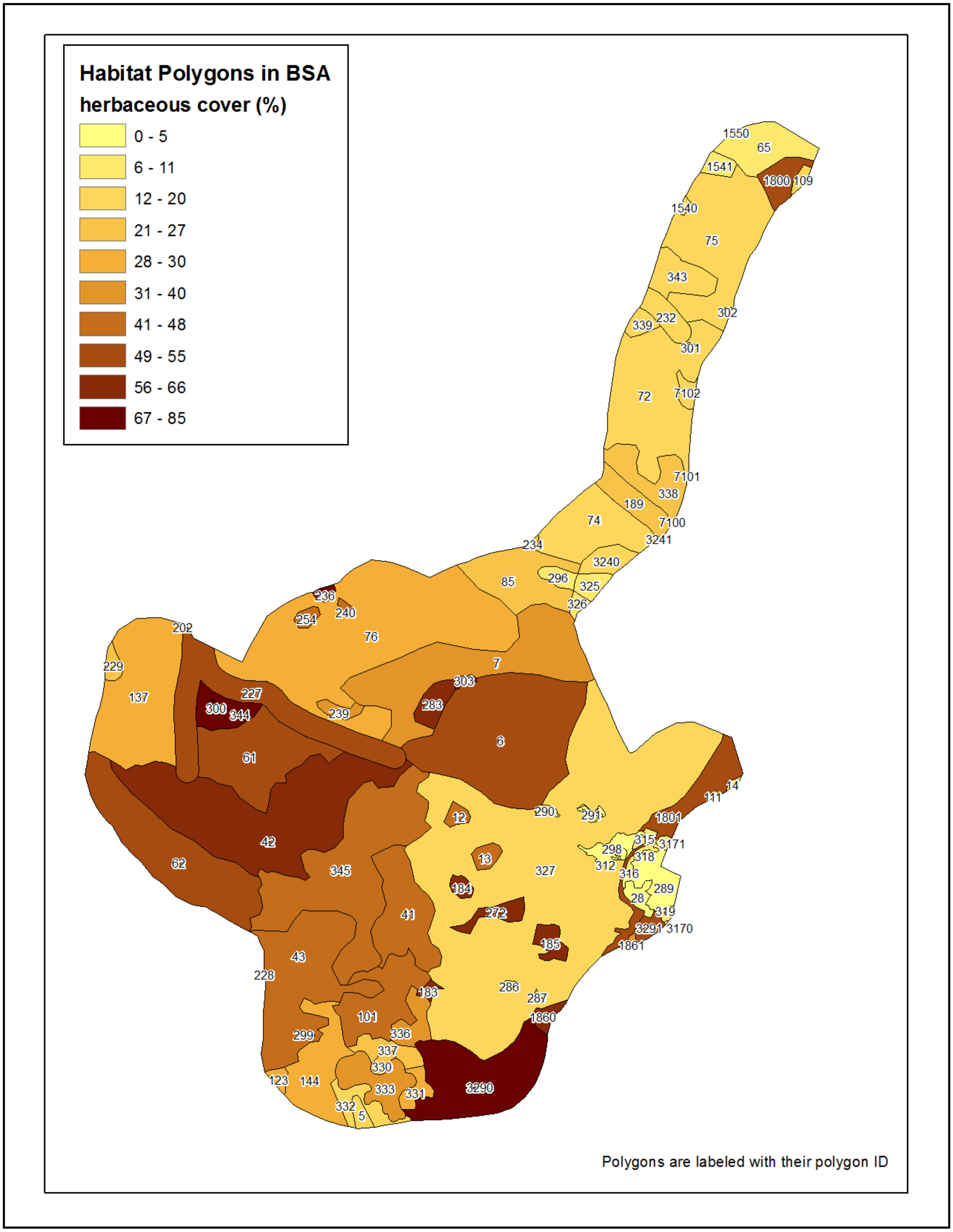

Figure 22. The herbaceous cover in the stands of the BSA.

Snags and Coarse Woody Debris

The presence of large snags and abundant coarse woody debris is critical to the survival of many wildlife species. The size and distribution of snags is illustrated in Figures 23, 24 and 25. The amount and distribution of coarse woody debris is illustrated in Figures 26 and 27.

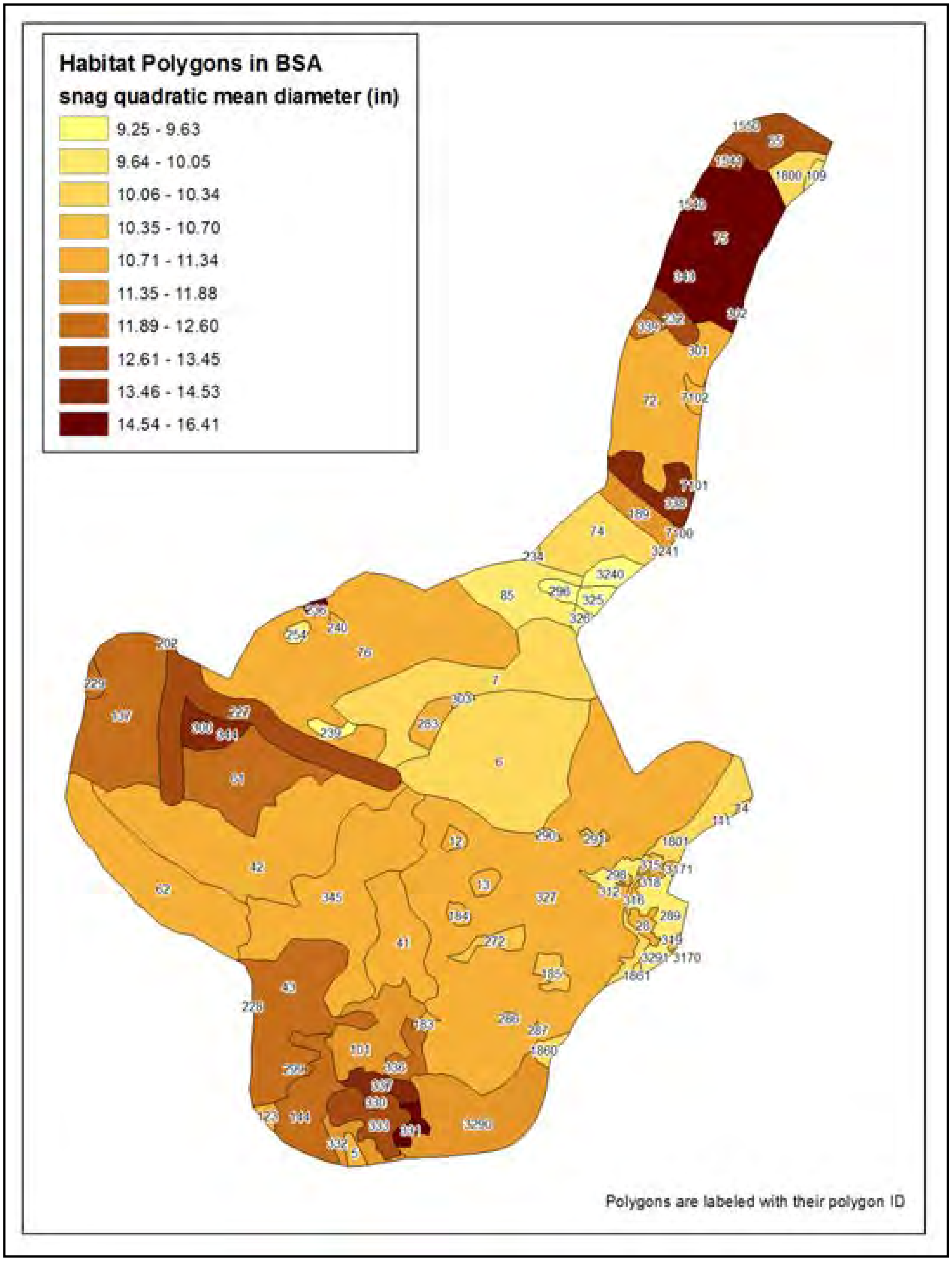

Figure 23. The quadratic mean diameter of snags in the stands of the BSA.

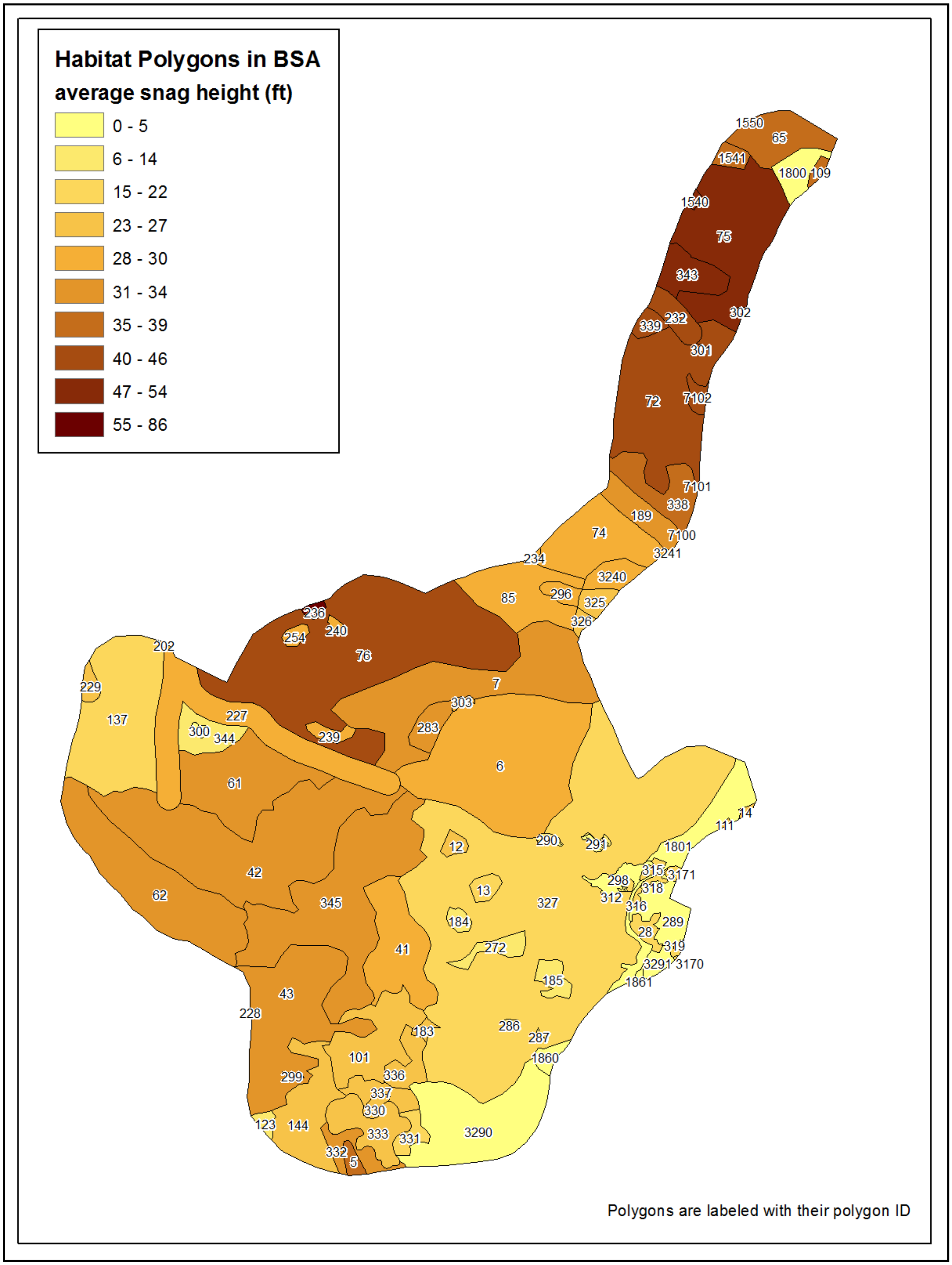

Figure 24. The average height of snags in the stands of the BSA.

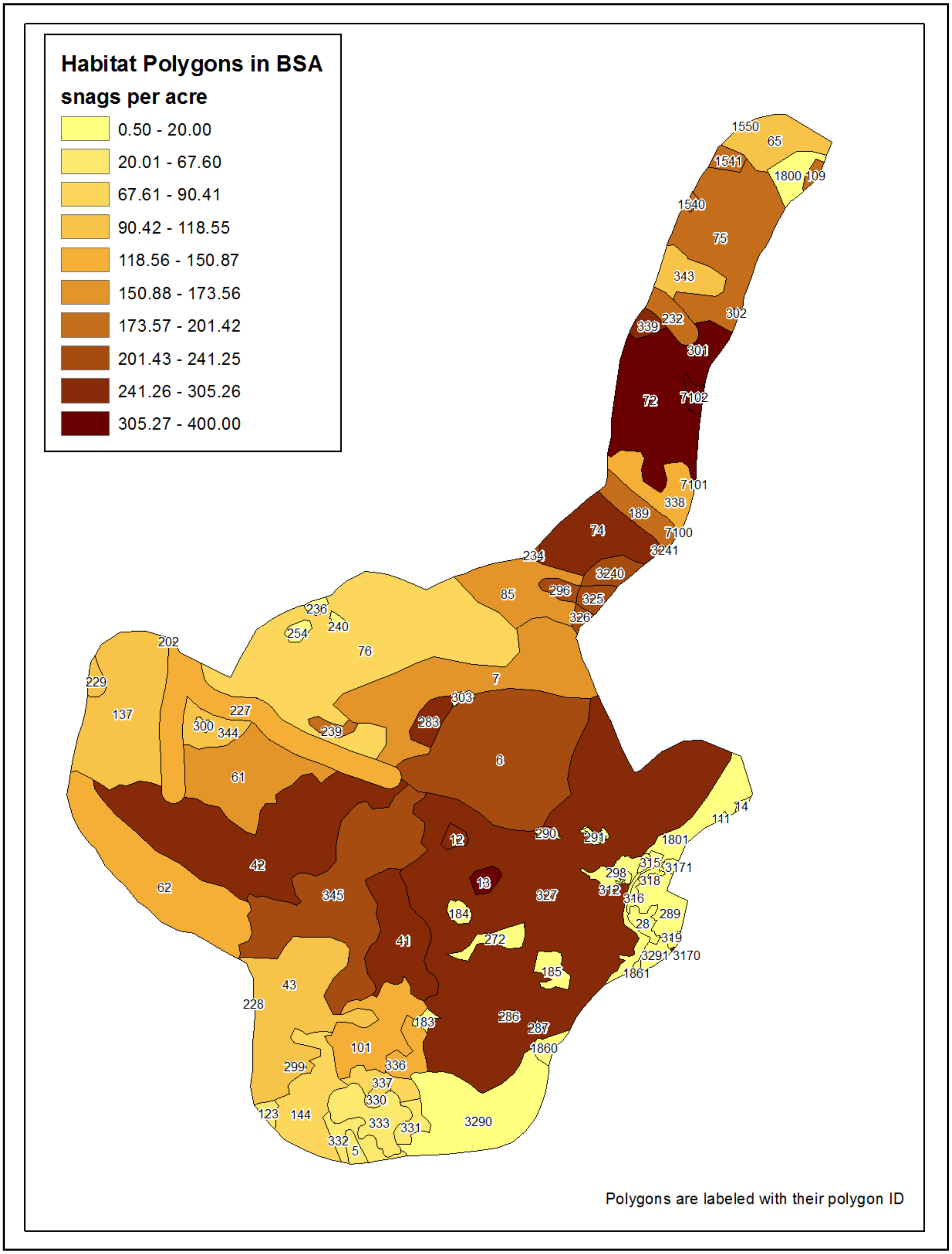

Figure 25. The density of snags in the stands of the BSA.

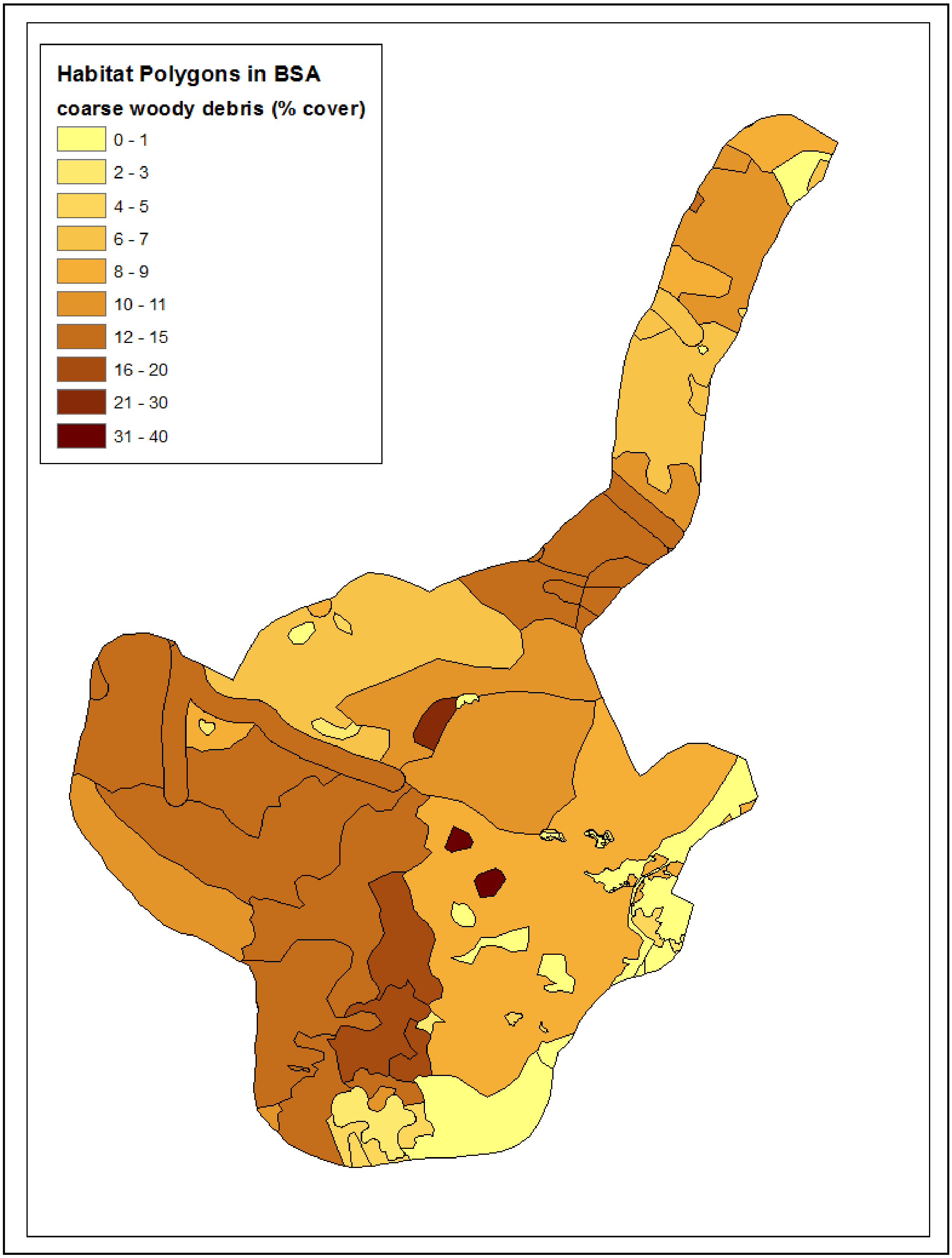

Figure 26. The percent cover of logs (coarse woody debris) in the stands of the BSA.

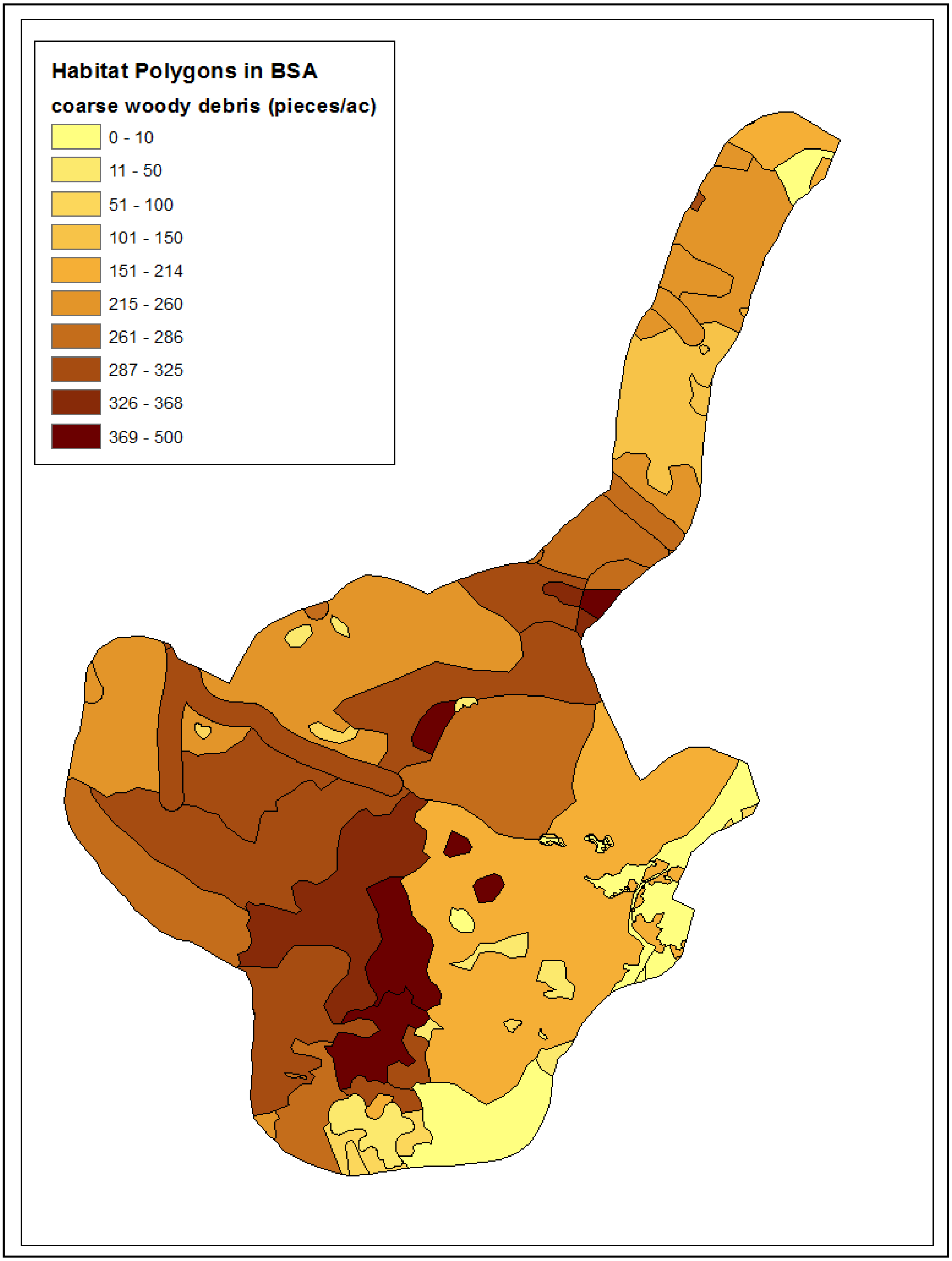

Figure 27. The number of logs per acre in the stands of the BSA.

Special Wildlife Habitat Features and Wildlife Observations

We noted many special wildlife habitat features and some wildlife observations during our field work. All of these are noted in the polygon database for the Biological Survey Area and included in the polygon descriptions that are presented in Appendix A. We summarize some of these special habitat feature and wildlife observations below.

Several of the plant associations are uncommon or possibly unique, particularly those in wetlands. These include the following within the BSA:

- Sitka alder-dominated wetlands (ALVIS/ATFI, ALVIS/Mesic Forb and ALVIS/SETR) with a total area of 6.8 acres as primary association.
- Unique wetland assemblages (HEMA80-RUOC2, CASCP, and SETR-VECA2), with none of these comprising a single primary PA.
- One unique talus community on a stream (RILA/Talus) that was a secondary plant association.
- Dry open meadows (CAGE2-CARU, ERUMM-FEVI, FEVI-FEID, PHDI3/ARCA7-IOST, PHDI3/FEVI-HICY) near the summit of Mt. Spokane State Park appear to be globally rare, but locally common with more habitat on the summit; these covered 20.9 acres as primary association.
- A shrub-dominated plant association (RUPA/Mixed Graminoids) described from further east that consistently had high wildlife use; these only occurred as secondary plant associations.

Polygons containing any of the above plant associations were noted as special ecological features in the polygon database (Special PA).

Polygons with characteristics of old growth forests were identified in the field and again following our data analysis. Old growth forests were characterized as stands with more than 8 trees per acre over 20 inches in diameter, with tall trees, large snags, canopy cover greater than 50% and 2 or 3 canopy layers. We identified 14 polygons as old growth forest and noted these in the polygon database. There are many other polygons that may contain potential old-growth forest or at least some of the attributes that comprise old-growth forest conditions.

During our field surveys of the BSA in 2010, we did not see most of the wildlife species listed in Table 4. We did see moose on several occasions, both outside and inside the BSA. We also saw abundant sign of moose in many parts of the SEIS Analysis Area and with the BSA. Moose are frequently seen by staff of the Mt. Spokane Ski Area and Mt. Spokane State Park.

We saw and heard pikas in most of the talus fields near the top of the mountain during our 2010 biological surveys. We also encountered frequent fresh sign of pika presence in these areas. These sightings are of particular interest, in that WDFW surveys for pika at the Mt. Spokane in the last several years have been negative. We do have conclusive evidence that there is pika presence within the BSA at this time, but do not know the size of the population.

We saw sign of pileated woodpecker excavations in snags scattered throughout the area, but did not see the bird during our surveys. We saw sign of white-tailed deer on occasion during our surveys, but did not encounter them in the BSA. We saw winter wrens on occasion, but did not encounter them in the BSA. We have seen goshawk previously at Mt. Spokane, but did not see the bird during our 2010 surveys of the BSA.

Wetlands and Streams

Wetlands and streams are a type of special habitat feature that are very important to many wildlife species. We noted the presence of wetlands and streams in each polygon during our fieldwork and mapped these features where we found them. We also used prior mapping of wetlands and streams done by the SE Group in 2009. Maps of the polygons within the BSA containing wetlands and streams, noted by either the SE Group or PBI, are presented in Figures 28 and 29. The polygon database for the Biological Survey Area contains a field for wetlands and another field for streams. This field notes the presence of wetlands and/or streams in each polygon. This information is also included in the polygon descriptions that are presented in Appendix A.

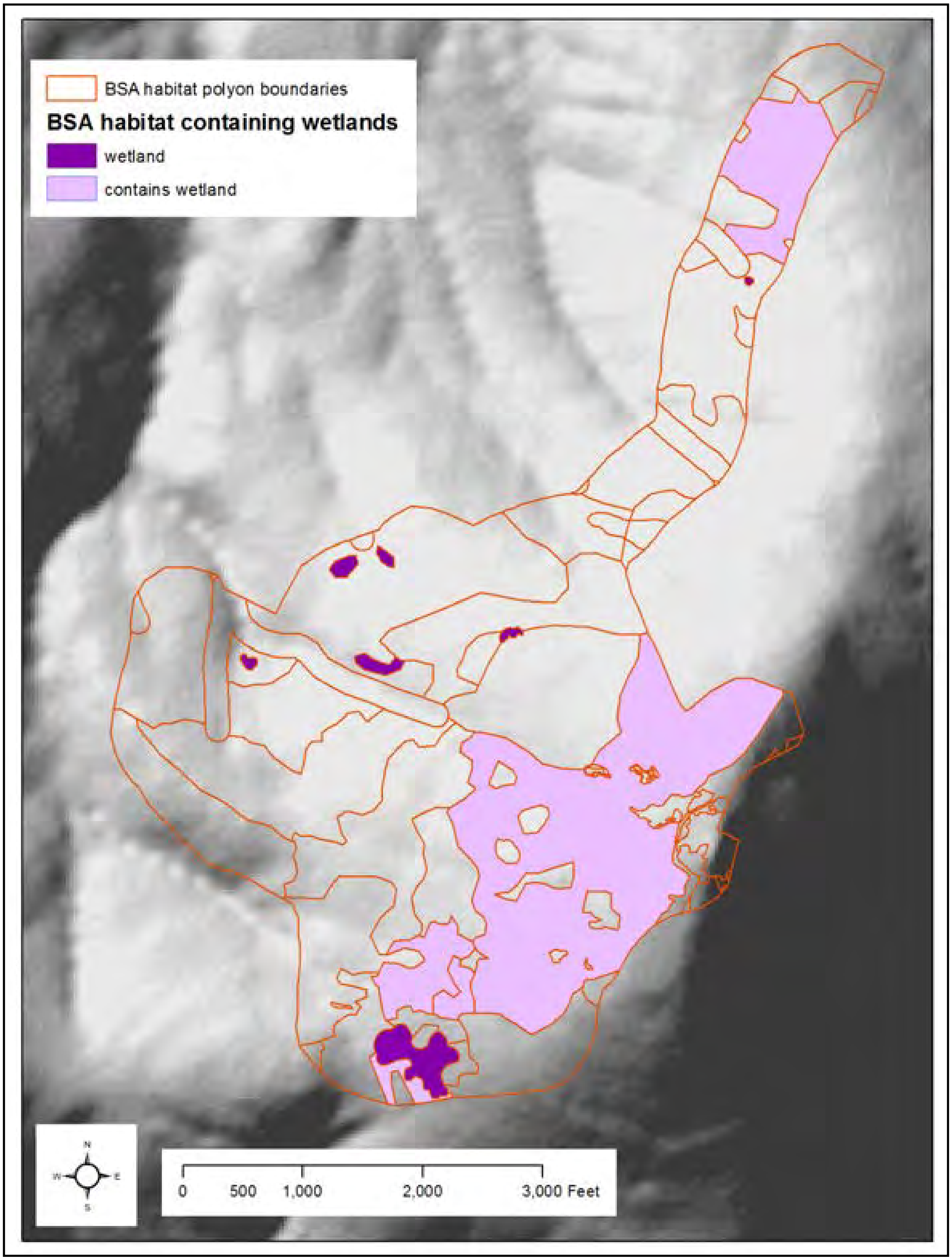

Figure 28. Polygons containing wetlands within the BSA.

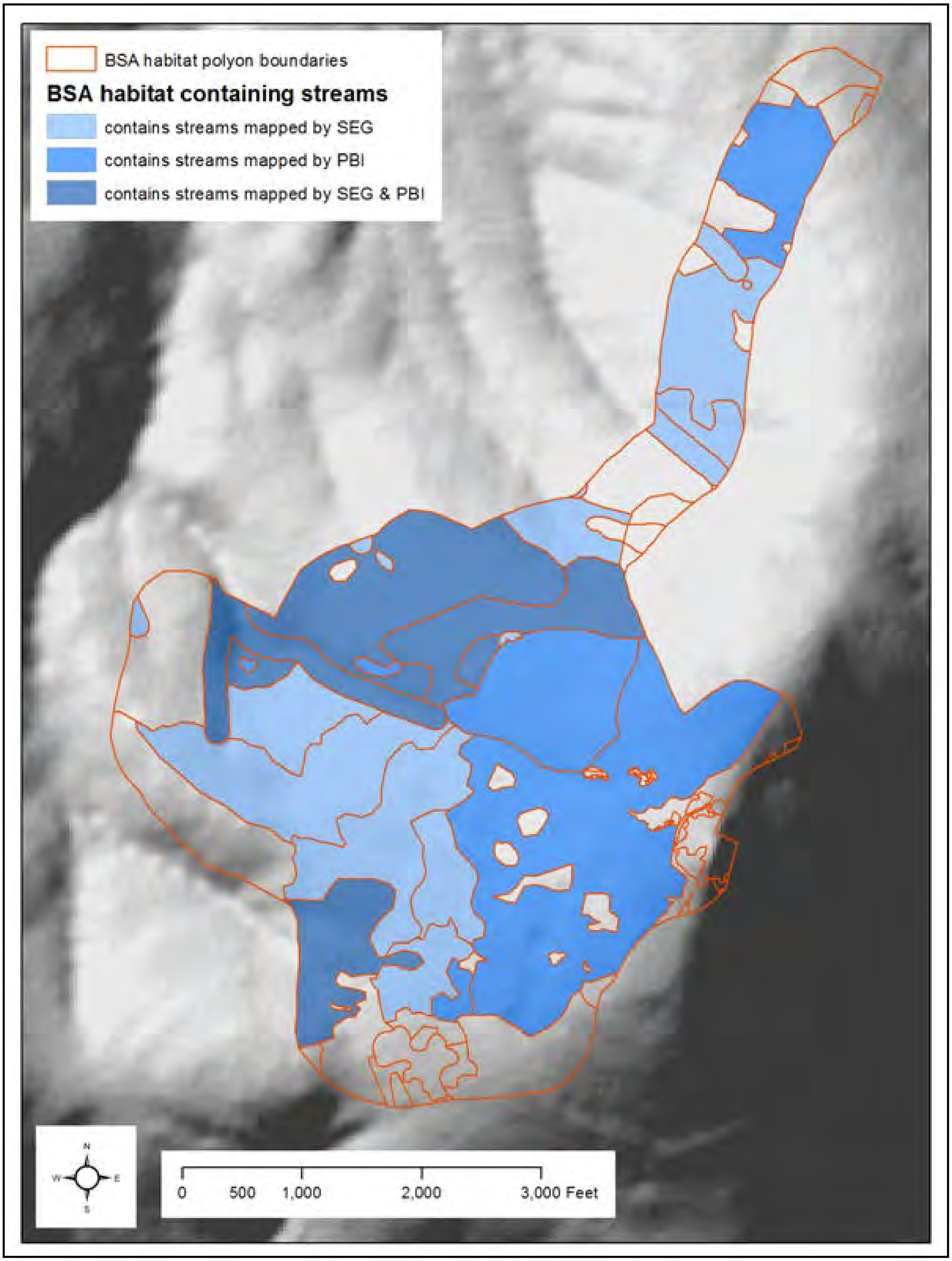

Figure 29. Polygons containing streams within the BSA.

Conclusions

We surveyed and mapped 325 habitat polygons in the SEIS analysis area and 92 habitat polygons within the Biological Survey Area (BSA). A wide diversity of habitat conditions was found in both areas. The biological survey area is dominated by subalpine and upper montane forests with patches of talus, meadows and small wetlands intermixed. The remainder of the SEIS analysis area is dominated by montane forests, also with meadows, talus, and small wetlands intermixed. Part of the SEIS analysis area consists of ski facilities and ski runs where vegetation management activities maintain habitat conditions in an early seral condition.

There are significant areas of old-growth forest within the BSA. These forests provide habitat for wildlife species dependent on late-successional forest condition. Much of the rest of the forests within the BSA also have some old, large trees and are moving toward old-growth conditions.

Nearly all the forest stands in the BSA have abundant large and small snags of various decay classes, providing abundant habitat for wildlife species that depend on snags for nesting, foraging and roosting. In some stands, snags are more common than live trees. Likewise, there is an abundance of coarse woody debris in the forests of the BSA. Many polygons within the BSA have very high levels of large coarse woody debris. There is no lack of habitat for wildlife species that depend on coarse woody debris for any of their life stages or activities within the BSA. Outside of the BSA, most forest stands also have abundant snags and coarse woody debris.

Most of the polygons within the BSA contain streams, springs and small wetlands. The north side of Mt. Spokane receives abundant moisture and holds the snowpack into the early summer. The resulting abundance of moisture is very evident throughout much of the BSA. The streams, springs and small wetlands that result provide habitat and water for many wildlife species, including many listed in Table 4 of this report.

In the western part of the BSA, it is readily apparent that the forests are unraveling due to a combination of root rot and blowdown during windstorms. Some of the habitat polygons that we mapped consisted largely of blowdown logs, snags and early successional shrubby and herbaceous vegetation along with small, young trees. As one moves east in the BSA, there is gradually less blowdown, but it appears that the root rot and blowdown may (or may not) be moving from the west to the east across the upper northern slopes of the mountain. The young trees that are growing in the blowdown areas will eventually form closed canopy, mature forests, but this will take many decades. The disturbance of the forest cause by the root rot and blowdown provide good habitat for some species at the same time it reduces habitat for species that depend on closed canopy, late-successional forest conditions.

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